



## 0.12 — Configuring your compiler: Choosing a language standard

👤 ALEX<sup>1</sup> 🕒 MARCH 13, 2024

With many different versions of C++ available (C++98, C++03, C++11, C++14, C++17, C++20, C++23, etc...) how does your compiler know which one to use? Generally, a compiler will pick a standard to default to. Typically the default is *not* the most recent language standard -- many default to C++14, which is missing many of the latest and greatest features.

If you wish to use a different language standard (and you probably will), you'll have to configure your IDE/compiler to do so.

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### Code names for in-progress language standards

Finalized language standards are named after the years in which they are finalized (e.g. C++17 was finalized in 2017).

However, when a new language standard is being worked on, it's not clear in what year the finalization will take place. Consequently, upcoming language standards are given code names, which are then replaced by the actual names upon finalization of the standard. You may still see the code names used in places (particularly for the latest in-progress language standard that doesn't have a finalized name yet).

Here's a mapping of code names to the finalized names:

Code name	Finalized name
C++0x	C++11
C++1y	C++14
C++1z	C++17
C++2a	C++20
C++2b	C++23
C++2c	C++26 (intended, not finalized yet)

For example, if you see `C++1z`, this is synonymous with language standard that became C++17. Because C++26 is not a finalized name yet, it is often called C++2c.

### As an aside...

C++11 has codename `C++0x` because it was originally expected to be finalized before 2010.

## Which language standard should you choose?

In professional environments, it's common to choose a language standard that is one or two versions back from the latest standard (e.g. if C++20 were the latest version, that means C++14 or C++17). This is typically done to ensure the compiler makers have had a chance to resolve defects, and so that best practices for new features are well understood. Where relevant, this also helps ensure better cross-platform compatibility, as compilers on some platforms may not provide full support for newer language standards immediately.

For personal projects and while learning, we recommend choosing the latest finalized standard, as there is little downside to doing so.

### Tip

Many compilers offer “experimental” or “preview” support for features from the upcoming non-finalized language standard. Your IDE may offer this as an option in the settings where you configure your language standard, or you may be able to enable it manually using the upcoming language standard's code name.

Support for features from non-finalized language standards will be incomplete and possibly buggy.

### Author's note

This website currently targets the C++17 standard, meaning our lessons and examples assume your compiler is C++17 capable. Some C++20 and C++23 content is available for those with compatible compilers.

To take full advantage of all the lesson content, we recommend using the latest language standard your compiler supports.

If your compiler doesn't support C++17, we recommend upgrading to one that does, or consider using an online compiler that supports C++17 or newer while learning.

At the end of this lesson, there is a test program you can run to see what language standard your compiler is using.

### A reminder

When changing your language standard (or any other project setting), make the change to all build configurations.

## Setting a language standard in Visual Studio

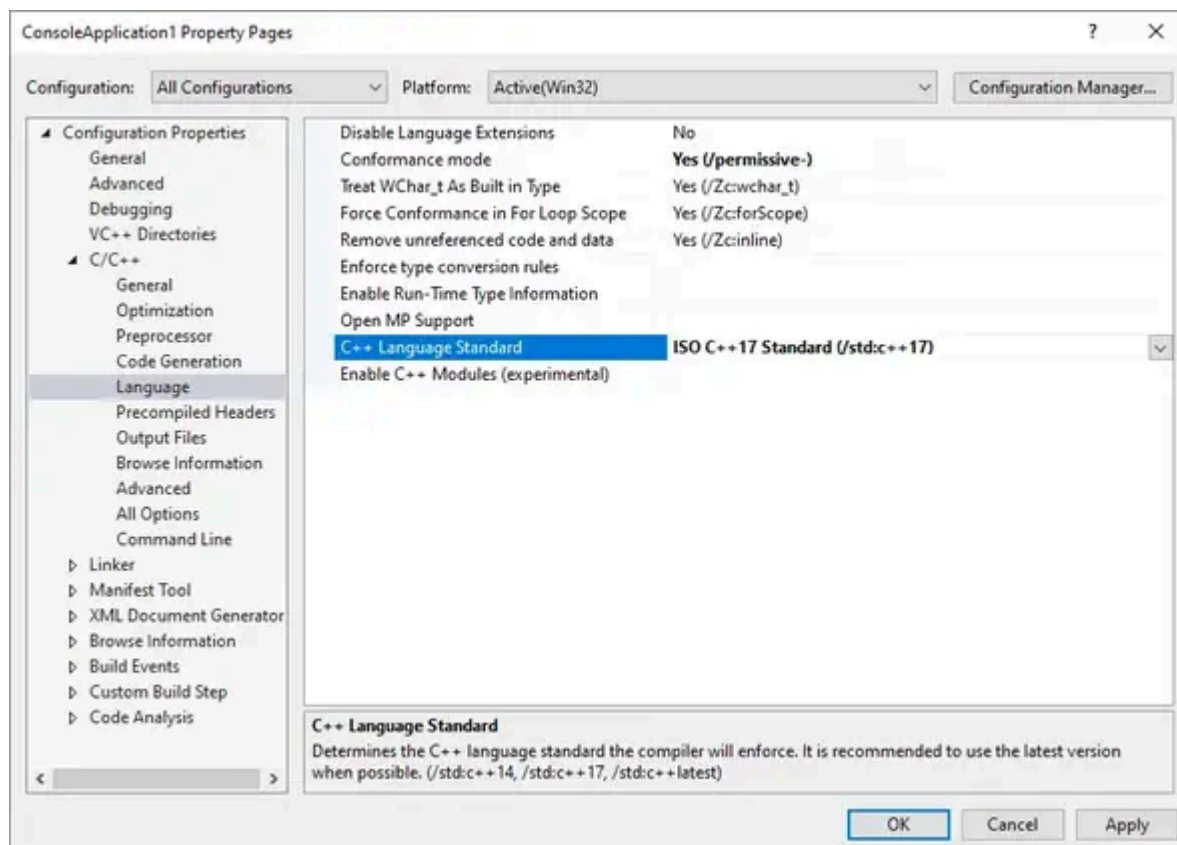
As of the time of writing, Visual Studio 2022 defaults to C++14 capabilities, which does not allow for the use of newer features introduced in C++17 and C++20.

To use these newer features, you'll need to enable a newer language standard. Unfortunately, there is currently no way to do this globally -- you must do so on a project-by-project basis.

### Warning

With Visual Studio, you will need to reselect your language standard every time you create a new project.

To select a language standard, open your project, then go to *Project menu > (Your application's Name) Properties*, then open *Configuration Properties > C/C++ > Language*.



First, make sure the *Configuration* is set to "All Configurations".

From there, you can set the *C++ Language Standard* to the version of C++ you wish to use.

### Tip

We recommend choosing the latest standard "ISO C++ Latest (/std:c++latest)", which will ensure you can use as many features as your compiler supports.

Make sure you're selecting the language standard from the dropdown menu (don't type it out).

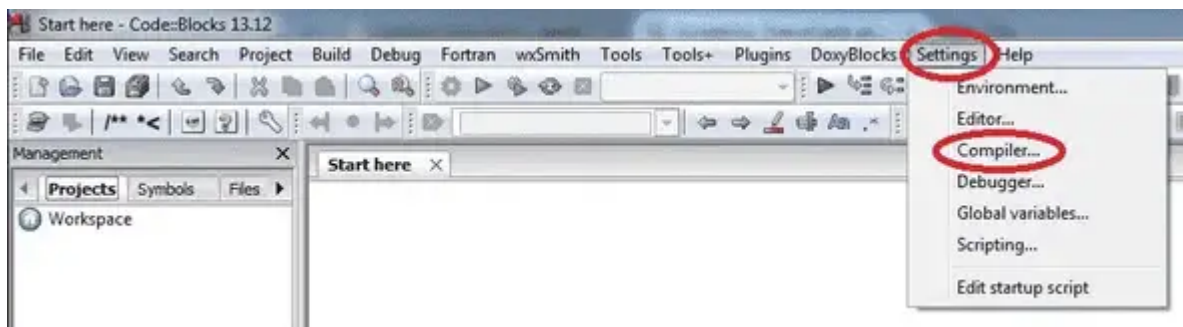
## Related content

For more information on Visual Studio language standard settings, Microsoft has a [Visual Studio language standard reference document \(https://docs.microsoft.com/en-us/cpp/build/reference/std-specify-language-standard-version?view=msvc-160\)](https://docs.microsoft.com/en-us/cpp/build/reference/std-specify-language-standard-version?view=msvc-160)<sup>3</sup>.

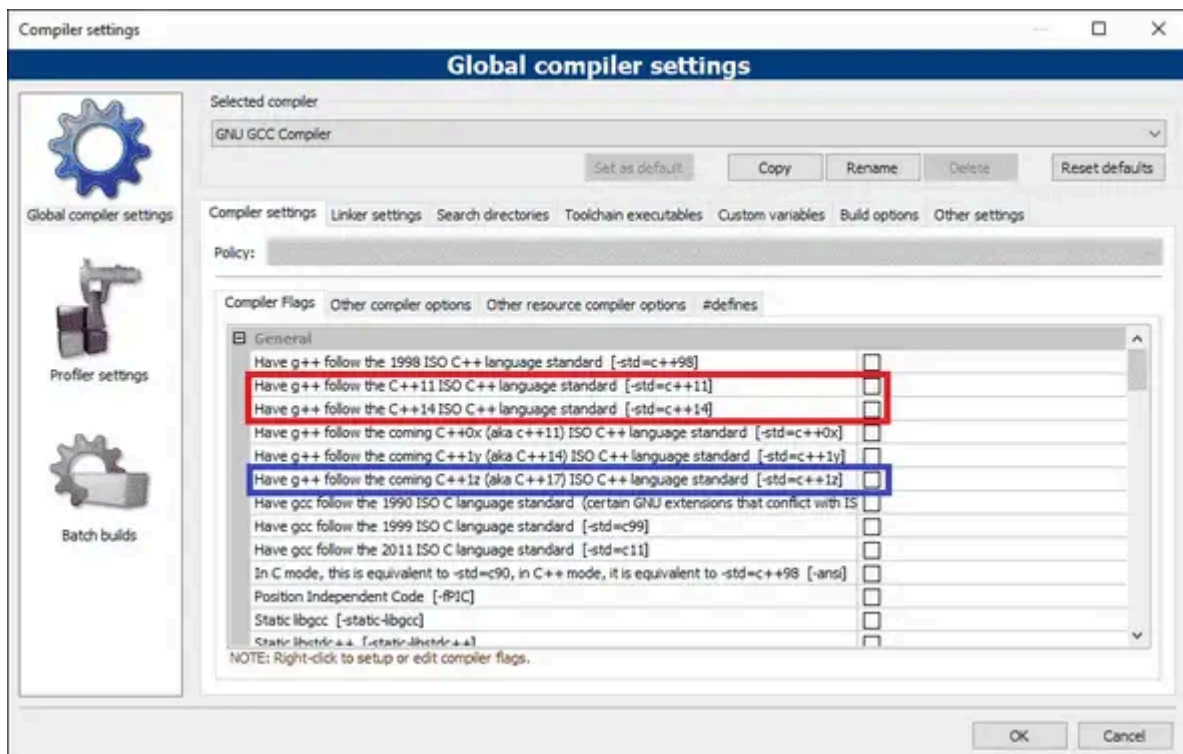
## Setting a language standard in Code::Blocks

Code::Blocks may default to a pre-C++11 language standard. You'll definitely want to check and ensure a more modern language standard is enabled.

The good news is that Code::Blocks allows setting your language standard globally, so you can set it once (rather than per-project). To do so, go to *Settings menu > Compiler...*:



Then find the checkboxes labeled *Have g++ follow the C++XX ISO C++ language standard [-std=c++XX]*, where XX is some number (e.g. 20, 17, etc...) representing a language standard:



If C++23, C++20, or C++17 appears in this list, select the one that represents the latest ISO standard (e.g. select *Have g++ follow the C++20 ISO language standard*). If you see GNU standards in this list as well, ignore them.

If you do not see C++17 in this list, upgrade to the latest version of Code::Blocks.

## Warning

As of the time of writing, the current version of Code::Blocks (20.03) is using an outdated compiler (GCC 8.1.0).

We recommend updating your compiler by updating MinGW. The procedure to do so can be found under the Code::Blocks section in lesson [0.6 -- Installing an Integrated Development Environment \(IDE\)](https://www.learncpp.com/cpp-tutorial/installing-an-integrated-development-environment-ide/) (<https://www.learncpp.com/cpp-tutorial/installing-an-integrated-development-environment-ide/>)<sup>4</sup>.

## Tip

After updating to the latest version of MinGW, you can see if newer language standard checkboxes appear in the *Settings menu > Compiler...* menu. If not, you can manually select a C++ version as follows:

- Find the “Other compiler options tab” of the “Global Compiler Settings” dialog.
- Add one of the following compiler options: `-std=c++11`, `-std=c++14`, `-std=c++17`, `-std=c++20`, or `-std=c++23` (to enable C++11/14/17/20/23 support respectively). You can also try the latest code name (e.g. `-std=c++2c`) for experimental support for features from the upcoming language standard.

## Setting a language standard in GCC/G++/Clang

For GCC/G++/Clang, you can use compiler options `-std=c++11`, `-std=c++14`, `-std=c++17`, `-std=c++20`, or `-std=c++23` (to enable C++11/14/17/20/23 support respectively). If you have GCC 8 or 9, you'll need to use `-std=c++2a` for C++20 support instead. You can also try the latest code name (e.g. `-std=c++2c`) for experimental support for features from the upcoming language standard.

## Setting a language standard for VS Code

For VS Code, you can follow the rules above for setting a language standard in GCC/G++/Clang.

Place the appropriate language standard flag (including the double quotes and comma) in the `tasks.json` configuration file, in the `"args"` section, on its own line before `"${file}"`.

We also want to configure Intellisense to use the same language standard. For C++20, in `settings.json`, change or add the following setting on its own line:

```
"C_Cpp.default.cppStandard": "c++20".
```

## What language standard is my compiler currently using?

The following program should print the language standard your compiler is currently configured to use. You can run this program to validate that your compiler is using the language standard you expect.

```
1  #include <iostream>
2
3  const int numStandards = 7;
4  const long stdCode[numStandards] = { 199711L, 201103L, 201402L, 201703L,
5  202002L, 202302L, 202612L};
6  const char* stdName[numStandards] = { "Pre-C++11", "C++11", "C++14",
7  "C++17", "C++20", "C++23", "C++26" };
8
9  long getCPPStandard()
10 {
11     // Visual Studio is non-conforming in support for __cplusplus (unless
12     // you set a specific compiler flag, which you probably haven't)
13     // In Visual Studio 2015 or newer we can use _MSVC_LANG instead
14     // See https://devblogs.microsoft.com/cppblog/msvc-now-correctly-
15     // reports-__cplusplus/
16     #if defined (_MSVC_LANG)
17         return _MSVC_LANG;
18     #elif defined (_MSC_VER)
19         // If we're using an older version of Visual Studio, bail out
20         return 1;
21     #else
22         // __cplusplus is the intended way to query the language standard code
23         // (as defined by the language standards)
24         return __cplusplus;
25     #endif
26 }
27
28 int main()
29 {
30     long standard = getCPPStandard();
31
32     if (standard == 1)
33     {
34         std::cout << "Error: Unable to determine your language standard.
35         Sorry.\n";
36         return 0;
37     }
38
39     std::cout << "Your compiler is using language standard: ";
40     for (int i = 0; i < numStandards; ++i)
41     {
42         if (standard <= stdCode[i])
43         {
44             std::cout << stdName[i];
45             // If the reported version is between two standard codes, this
46             // must be a preview / experimental support
47             if (standard < stdCode[i])
48                 std::cout << " (preview)";
49             break;
50         }
51     }
52
53     std::cout << '\n';
54
55     return 0;
56 }
```

## Author's note

If the above doesn't work, your compiler may be non-conforming. Please let me know if the above doesn't work with any of the major modern compilers.

## Exporting your configuration

Having to reselect all of your settings options every time you create a new project is burdensome. Fortunately, most IDEs provide a way to export your settings. This is typically done by creating a new project template with the settings you want, and then selecting that project template when you create a new project.

### For Visual Studio users

In Visual Studio, this option is available via Project -> Export Template. Select "Project template", add a name and optional description (e.g. C++20 console application), and then click "Finish".

Next time you create a new project, you'll see this template show up in your list of project templates.

Once you create a new project with this template, it may not open any files. You can open up your .cpp file in the Solution Explorer window by going to Solution -> <Project Name> -> Source Files -> <template name>.cpp.

### For Code::Blocks users

In Code::Blocks, choose File -> Save project as template. Give your template a title, and save.

When you create a new project, you will find this template under the "User templates" option.

## Where can I view the C++ standards document?

Each C++ language standard is described by a **standards document**, which is a formal technical document that is the authoritative source for the rules and requirements of a given language standard. The standards document is not designed for learning -- rather, it's designed for compiler writers to be able to implement new language standards accurately. You will occasionally see people quoting the standards document when explaining how something works.

The approved C++ standards document for a given language standard is not available for free. There is a link to purchase the latest standard [here \(https://isocpp.org/std/the-standard\)](https://isocpp.org/std/the-standard)<sup>5</sup>.

When a new language standard is being developed, draft standards documents are published for review. These drafts *are* available online for free. The last draft standard before the approved standard is generally close enough to the official standard to use for most purposes. You can find the draft standards [here \(https://www.open-std.org/jtc1/sc22/wg21/docs/standards\)](https://www.open-std.org/jtc1/sc22/wg21/docs/standards)<sup>6</sup>.



## Compilers often have incomplete support for new language features

Even after a language standard is finalized, compilers supporting that language standard may still have missing, partial, or buggy support for certain features.

If you attempt to compile a program that should compile but mysteriously won't, it's likely because of one of two reasons:

- Your compiler is configured to use an older language standard that doesn't support the feature you are using. Try selecting a newer language standard and compile your program again. You can use the program above to validate that you have configured your language standard selection correctly.
- The version of the compiler you are running may have missing, partial, or buggy support for a feature you are using.

The CplusplusReference website tracks compiler support for each feature per language standard. You can find those support tables linked from their [home page \(https://en.cppreference.com/w/cpp\)](https://en.cppreference.com/w/cpp)<sup>7</sup>, top right, under "Compiler Support" (by language standard). For example, you can see which C++23 features are supported [here \(https://en.cppreference.com/w/cpp/compiler\\_support/23\)](https://en.cppreference.com/w/cpp/compiler_support/23)<sup>8</sup>.

If a newer version of your compiler supports the problematic feature, you can upgrade your compiler to the latest version and try compiling your program again. If the latest version of your compiler still doesn't support the feature you are trying to use, you can either try a different compiler that does provide support, or find a solution using a different set of features.



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B U URL INLINE CODE C++ CODE BLOCK HELP!



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 Avatars from <https://gravatar.com/><sup>15</sup> are connected to your provided email address.

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**j3573r**

🕒 April 8, 2024 10:08 am

why does it show error when i use `#include <bits/stdc++.h>` with this compiler setup?

👍 0

➡ Reply



**ceapa**

🕒 March 26, 2024 7:34 am

On VS Code the language standard seems to have only changed after a reload. Does every change to a .json file need a reload of VS Code to take effect?

👍 1

➡ Reply



**Brando**

🕒 March 18, 2024 2:15 pm

I made a template with the hello world file with all our settings. Loaded it into a new project and copy pasted the language standard code. I got it to build correctly but when I run it it just prints hello world. How is this possible? Why isn't it running the code it's compiling? Thanks!

👍 0

➡ Reply



**flybella**

🕒 March 16, 2024 3:05 pm

I'm on mac running XCode 14.2 and the build failed for me with these notes:

"Command CompileC failed with a nonzero exit code."

"Could not read serialized diagnostics file: error("Failed to open diagnostics file")

I checked the language standard in build settings and it looks like it's running c++20

👍 0

➡ Reply



**chinh4thepro**

🕒 March 12, 2024 7:10 am



The code used to check the language standard compiled with clang (on macos) fails to compile with the error:

```
1 | check.cpp:27:16: error: expected ';' at end of declaration
2 |     long standard{getCPPStandard()};
3 |                   ^
4 |                   ;
5 | 1 error generated.
```

🔗 Last edited 28 days ago by chinh4thepro

👍 1

➡ Reply



**Alex** Author

🔗 Reply to chinh4thepro<sup>16</sup> 🕒 March 13, 2024 1:33 pm

Mistake on my part. I changed this statement to use copy initialization, which should work on pre-C++11 compilers.

👍 1

➡ Reply



**Alex**

🔗 Reply to chinh4thepro<sup>16</sup> 🕒 March 12, 2024 3:12 pm

Same. On a Mac, and g++ is actually an alias for the built-in older version of clang++.

Try adding the '-std=c++11' to see if that fixes it (though this does defeat the purpose of the program, as it will just spit out what you fed it.)

👍 0

➡ Reply



**chinh4thepro**

🔗 Reply to Alex<sup>17</sup> 🕒 March 13, 2024 7:52 am

When I try declaring the standard version, clang spits out an error about missing/undefined symbols for x86\_64... I've just ended up using clang provided by

Nix.

 Last edited 27 days ago by [chinh4thepro](#)

 0

 Reply



**Risky**

 February 28, 2024 11:50 am

Excuse me, just to verify since I couldn't manage to find anyone else who asked this but do I code the program in this lesson within the HelloWorld solution or even the project itself? Asking because while on the one hand I get that we are checking what compiler version is being run for our project, and that in my case as a Visual Studio 2022 user, I have to manually swap out the compiler settings (or do it through a settings preset) to have it be the version we want, from what I recall, the best practices or tendencies within this tutorial series is to make programs and projects into their own separate solution.

 0

 Reply



**Alex** Author

 Reply to [Risky](#)<sup>18</sup>  March 4, 2024 11:23 am

Paste the program into your current project and run it to see what language standard that project is configured for. Then delete it and write your own program.

 1

 Reply



**Risky**

 Reply to [Alex](#)<sup>19</sup>  March 7, 2024 3:43 pm

Sorry for taking this long to reply but that worked! | confirmed that my program was indeed running on the language standard of C++20. Thank you so much for the help Alex!

 0

 Reply



**Tensai**

 February 27, 2024 9:32 pm

The code works for me but there is a problem. I've changed the Cpp standard to C++20 as indicated in the tutorial. I also checked in VS Code settings and the Cpp standard version for my compiler is C++20. But the output of the code is **"Your compiler is using language standard: C++14"**. Does anyone have an explanation for this?

**using VS Code on WSL(Windows Subsystem for Linux). compiler g++**

 Last edited 1 month ago by [Tensai](#)

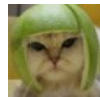
 0 Reply**Alex** Author Reply to [Tensai](#)<sup>20</sup>  March 2, 2024 1:09 pm

The most likely explanation is that you either changed the wrong setting, or your compiler isn't picking the setting up for some reason.

Can you compile any code that requires C++17 or C++20?

 0 Reply**Tensai** Reply to [Alex](#)<sup>21</sup>  March 4, 2024 7:20 pm

No. I always have a compiler path error. So, I'm obliged to generate an executable from the terminal and then run that executable.

 0 Reply**Alex** Author Reply to [Tensai](#)<sup>22</sup>  March 6, 2024 9:44 pm

When you invoke your compiler from the command line, use command line argument `-std=c++20` and see if that works.

 0 Reply**Hassen** February 26, 2024 10:41 am

The code did not work correctly. I am using VS code for windows 10.

 0 Reply**Alex** Author Reply to [Hassen](#)<sup>23</sup>  February 27, 2024 8:28 pm

What did it do? What compiler are you using?

 0 Reply**Hassen** Reply to [Alex](#)<sup>24</sup>  March 1, 2024 10:29 pm

I am using VScode



0



Reply



🇺🇸🇺🇸🇺🇸

🕒 February 17, 2024 3:40 am

Why do I (Visual Studio) show that this file is illegal and cannot be created when creating a project template (I use Visual Studio)



0



Reply

**EMP**

🕒 February 16, 2024 12:07 am

Output was filled with unreachable code lines & console returning the "Error: Unable to determine your language standard." line when ran.

In case anyone else runs into this make sure to delete semicolons from lines ending in parenthesis - even though VS allows with the warning level configured as in this tutorial it's not needed.



0



Reply

## Links

1. <https://www.learncpp.com/author/Alex/>
2. <https://ikeamenu.com/humix/video/lpms8sWsckf>
3. <https://docs.microsoft.com/en-us/cpp/build/reference/std-specify-language-standard-version?view=msvc-160>
4. <https://www.learncpp.com/cpp-tutorial/installing-an-integrated-development-environment-ide/>
5. <https://isocpp.org/std/the-standard>
6. <https://www.open-std.org/jtc1/sc22/wg21/docs/standards>
7. <https://en.cppreference.com/w/cpp>
8. [https://en.cppreference.com/w/cpp/compiler\\_support/23](https://en.cppreference.com/w/cpp/compiler_support/23)
9. <https://www.learncpp.com/cpp-tutorial/statements-and-the-structure-of-a-program/>
10. <https://www.learncpp.com/>
11. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-warning-and-error-levels/>
12. <https://www.learncpp.com/configuring-your-compiler-choosing-a-language-standard/>
13. [https://www.learncpp.com/cpp-tutorial/introduction-to-stdstring\\_view/](https://www.learncpp.com/cpp-tutorial/introduction-to-stdstring_view/)
14. <https://www.learncpp.com/cpp-tutorial/introduction-to-iterators/>

15. <https://gravatar.com/>
16. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-choosing-a-language-standard/#comment-594583>
17. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-choosing-a-language-standard/#comment-594594>
18. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-choosing-a-language-standard/#comment-594141>
19. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-choosing-a-language-standard/#comment-594263>
20. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-choosing-a-language-standard/#comment-594131>
21. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-choosing-a-language-standard/#comment-594208>
22. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-choosing-a-language-standard/#comment-594293>
23. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-choosing-a-language-standard/#comment-594059>
24. <https://www.learncpp.com/cpp-tutorial/configuring-your-compiler-choosing-a-language-standard/#comment-594121>